REMARKS

Favorable reconsideration of this application is requested in view of the following remarks.

Claim 1 has been amended to include the minimum content of a transition metal oxide (T-oxide) that is a part of limitations of claim 2 and accordingly, claim 2 is amended to delete the limitation included in claim 1; claim 8 has been rewritten in an independent form of original claim 1 and amended as supported by the specification at page 4, lines 33-36, page 8, lines 25-30 and Fig. 3; and claims 22-26 have been added as supported by the specification at page 8, lines 25-30 and Fig. 3 and original claims 10-14. See also the specification at page 9, line 36 – page 10, line 1, page 10, line 1, page 10, lines 6-8, page 10, lines 8-9, and page 10, lines 11-14 for claims 22, 23, 24, 25 and 26, respectively.

Claims 18-21 have been canceled without prejudice.

Claims 8 and 9 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Applicants respectfully traverse this rejection.

Conventionally, glass was made by a melting method and did not include crystals. However, since new glass such as glass-ceramics has been developed, glass including crystals is well recognized among those skilled in the art (see a copy of Abstract of "Nano-crystal glass-ceramics obtained by crystallization of vitrified red mud" provided by CABI attached hereto). Therefore, these claims are definite, and this rejection should be withdrawn. Applicants do not concede the correctness of this rejection.

Claims 1-7 and 10-11 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. (U.S. Patent Application Publication No.

2001/0021685) in view of Sullivan et al. (U.S. Patent No. 5,753,371). Applicants respectfully traverse this rejection.

Sakaguchi discloses that the minimum visible-light transmission of the glass is 70 % when the glass thickness is 4 mm (see para. 0052). In contrast, claim 1 requires that the maximum visible-light transmission be 85 % when thickness of the glass flake is 15 μm. In general, the light transmission decreases when the thickness of the sample increases according to Beer-Lambert Law (see a copy of Beer-Lambert Law provided by the University of Adelaide, Department of Chemistry attached hereto). According to Beer-Lambert Law, the light absorption (A) is proportional to the path length, i.e., thickness of the glass, and the relationship between the light absorption (A) and light transmission (T) is provided by a formula $A = -\log T$. Therefore, when the thickness of the glass flake is 4 mm as provided by Sakaguchi, i.e., 267 times thicker than the thickness required by claim 1, the light absorption is 267 times larger than the absorption of the glass flake of claim 1. Accordingly, the light transmission of the glass flake of claim 1 with 4 mm thickness would be nearly 0 %[1] and would be far less than 70 % that Sakaguchi requires. In addition, Sakaguchi discloses a minimum limit of total ion oxide content as 0.02 wt % and preferred maximum limits of total Fe_2O_3 content of 1.0 wt % if the glass contains no Se, and 0.6 wt % if the glass contains Se (see para. 0063). In contrast, claim 1 of the present invention requires more than 10 mass % of a transition metal oxide such as Fe_2O_3 in the glass flake. This minimum requirement of claim 1 is 500 times higher than the minimum limit 0.02 wt % of Sakaguchi and 10 times higher than the preferred maximum limit 1.0 wt % if the glass contains no Se, or 16.7 times higher than the preferred maximum limit 0.6 wt % if the glass contains Se. In addition, Sakaguchi discloses a content of other transition metal oxides such as TiO_2, CoO, and CeO_2, as max. 1.0 wt %, max. 0.005 wt %, and max. 2.0 wt %, respectively (see paras. 0020- 0022). The total of the preferred content of Fe_2O_3, TiO_2, CoO, and CeO_2 is therefore, 4.005 wt % even if no Se is contained and still much lower than 10 mass % that claim 1 requires. Therefore, claim 1 is distinguished from Sakaguchi. In addition, Sullivan discloses or suggests neither that the T-metal oxide content is more than 10 mass

[1] $1/10^{267}$ of the transmission of the glass flake with 15 μm thickness.

% in the glass flake nor that the maximum visible light transmission is 85 % of the glass flake with the thickness of 15 μm. Therefore, Sullivan does not remedy the deficiencies of Sakaguchi. Accordingly, claim 1 is distinguished from Sakaguchi in view of Sullivan, and the rejection of claims 1-7 and 10-11 should be withdrawn.

Claim 12-13 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. (U.S. Patent Application Publication No. 2001/0021685) in view of Sullivan et al. (U.S. Patent No. 5,753,371) and in further view of Fujita et al. (Japanese Patent Application Publication No. H5-017710). Applicants respectfully traverse this rejection.

Claims 12 and 13 are distinguished from Sakaguchi in view of Sullivan for at least the same reasons as discussed above for claim 1. Fujita discloses or suggests neither that the T-metal oxide content in the glass flake is more than 10 mass % nor that the maximum visible light transmission of the glass flake is 85 % with the thickness of 15 μm. Therefore, Fujita does not remedy the deficiencies of Sakaguchi. Accordingly, claims 1, 12, and 13 are distinguished from Sakaguchi in view of Sullivan and further in view of Fujita, and the rejection should be withdrawn. Applicants do not concede the correctness of the rejection.

Claim 12 and 14 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Sakaguchi et al. (U.S. Patent Application Publication No. 2001/0021685) in view of Sullivan et al. (U.S. Patent No. 5,753,371) and in further view of Marshall et al. (U.S. Patent No. 3,331,699). Applicants respectfully traverse this rejection.

Claims 12 and 13 are distinguished from Sakaguchi in view of Sullivan for at least the same reasons as discussed above for claim 1. Marshall discloses metal oxides that are used for coating on glass flakes (see, for example, coln. 5, lines 51-62; and coln. 6, lines 52-55) but are not included in the glass flakes, and the reference does not disclose or suggest that the T-metal oxide content in the glass flake is more than 10 mass % nor that the maximum visible light transmission is 85 % when the thickness of the glass flake is 15 μm. Therefore, Marshall does not remedy the deficiencies of Sakaguchi.

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Accordingly, claims 1, 12, and 14 are distinguished from Sakaguchi in view of Sullivan and further in view of Marshall, and the rejection should be withdrawn. Applicants do not concede the correctness of the rejection.

In view of the above, Applicants request reconsideration of the application in the form of a Notice of Allowance.

Respectfully submitted,

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Dated: June 24, 2008

By: _____
Douglas P. Mueller
Reg. No. 30,300

DPM/my/ad

English Title: Nano-crystal glass-ceramics obtained by crystallization of vitrified red mud.
Personal Authors: Peng Fei, Liang KaiMing, Shao Hua, Hu AnMin
Author Affiliation: Department of Materials Science and Engineering, Tsinghua University, Beijing 100084, China.
Editors: No editors
Document Title: Chemosphere, 2005 (Vol. 59) (No. 6) 899-903

Abstract:
Glass has been obtained by melting red mud from Shandong Province in China with different additives. Suitable thermal treatments were employed to convert the obtained glass into nano-crystal glass-ceramics. X-ray diffraction (XRD) patterns showed that the main crystalline phase in both the glass-ceramics is wollastonite ($CaSiO_3$). These crystals are homogeneously dispersed within the parent glass, with an average crystal size of less than 100 nm. The size of nano-crystals varies when different thermal processes were used. Physical and mechanical properties, such as density, thermal expansion coefficient, hardness, and bending strength, of the two glasses have been examined and the corresponding microstructures are discussed. These results demonstrate that both glass-ceramics have potential for a wide range of construction application.

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Beer-Lambert Law

Introduction

The Beer-Lambert law (or Beer's law) is the linear relationship between absorbance and concentration of an absorbing species. The general Beer-Lambert law is usually written as:

$A = a(\lambda) * b * c$

where A is the measured absorbance, $a(\lambda)$ is a wavelength-dependent absorptivity coefficient, b is the path length, and c is the analyte concentration. When working in concentration units of molarity, the Beer-Lambert law is written as:

$A = \varepsilon * b * c$

where ε is the wavelength-dependent molar absorptivity coefficient with units of M^{-1} cm^{-1}.

Instrumentation

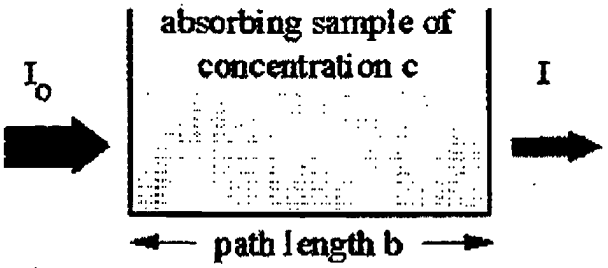
Experimental measurements are usually made in terms of transmittance (T), which is defined as:

$T = I / I_o$

where I is the light intensity after it passes through the sample and I_o is the initial light intensity. The relation between A and T is:

$A = -\log T = -\log (I / I_o)$.

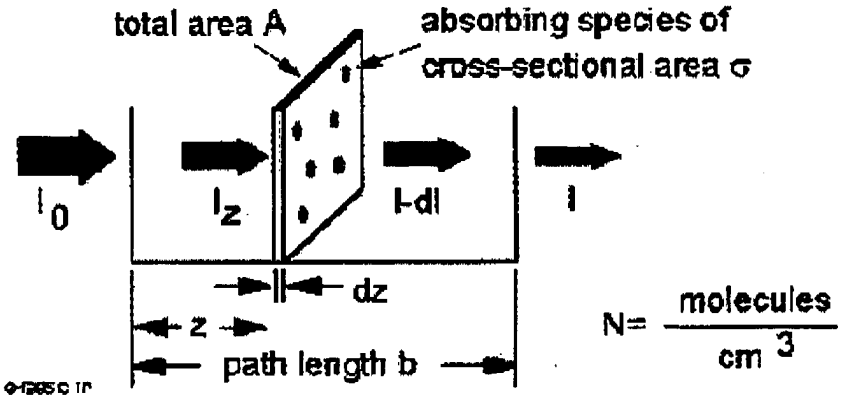
Absorption of light by a sample



Modern absorption instruments can usually display the data as either transmittance, %-transmittance, or absorbance. An unknown concentration of an analyte can be determined by measuring the amount of light that a sample absorbs and applying Beer's law. If the absorptivity coefficient is not known, the unknown concentration can be determined using a working curve of absorbance versus concentration derived from standards.

Derivation of the Beer-Lambert law

The Beer-Lambert law can be derived from an approximation for the absorption coefficient for a molecule by approximating the molecule by an opaque disk whose cross-sectional area, σ, represents the effective area seen by a photon of frequency w. If the frequency of the light is far from resonance, the area is approximately 0, and if w is close to resonance the area is a maximum. Taking an infinitesimal slab, dz, of sample:



I_0 is the intensity entering the sample at z=0, I_z is the intensity entering the infinitesimal slab at z, dI is the intensity absorbed in the slab, and I is the intensity of light leaving the sample. Then, the total opaque area on the slab due to the absorbers is $\sigma * N * A * dz$. Then, the fraction of photons absorbed will be $\sigma * N * A * dz / A$ so,

$dI / I_z = - \sigma * N * dz$

Integrating this equation from z = 0 to z = b gives:

$\ln(I) - \ln(I_0) = - \sigma * N * b$

or $- \ln(I / I_0) = \sigma * N * b$.

Since N (molecules/cm^3) * (1 mole / 6.023×10^{23} molecules) * 1000 cm^3 / liter = c (moles/liter)

and 2.303 * log(x) = ln(x)

then $- \log(I / I_0) = \sigma * (6.023 \times 10^{20} / 2.303) * c * b$

or $- \log(I / I_0) = A = \varepsilon * b * c$

where $\varepsilon = \sigma * (6.023 \times 10^{20} / 2.303) = \sigma * 2.61 \times 10^{20}$

Typical cross-sections and molar absorptivities are:

		σ (cm^2)	ε (M^{-1} cm^{-1})
absorption -	atoms	10^{-12}	3×10^{8}
	molecules	10^{-16}	3×10^{4}
	infrared	10^{-19}	3×10
Raman scattering		10^{-29}	3×10^{-9}

Limitations of the Beer-Lambert law

The linearity of the Beer-Lambert law is limited by chemical and instrumental factors. Causes of nonlinearity include:

- deviations in absorptivity coefficients at high concentrations (>0.01M) due to electrostatic interactions between molecules in close proximity
- scattering of light due to particulates in the sample
- fluoresecence or phosphorescence of the sample
- changes in refractive index at high analyte concentration
- shifts in chemical equilibria as a function of concentration
- non-monochromatic radiation, deviations can be minimized by using a relatively flat part of the absorption spectrum such as the maximum of an absorption band
- stray light

Related Topics

- Introduction to spectroscopy

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